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THE CHEMISTS OF AMERICA

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AT a recent meeting of the Washington Academy of Sciences, the chemical representative with the British mission in this country told the audience that the side with the best chemists will probably win the war. This is worth remembering when our statesmen fill themselves, the newspapers, and the people with war knowledge.

Perhaps some will take our Britisher to task for giving undue importance to his sphere of activity. If so, let the facts speak for themselves. Until shortly before the outbreak of the war the nitrate supply of the world came from Chili. With it the world's supply of fertilizer was satisfied; with it, nitric acid, and hence our various modern explosives, were manufactured. But the deposits, like those of coal, have their limits; and the world's needs were emptying the nitrate deposits even faster than those of coal. The situation was alarming but not hopeless, for at this point the chemist stepped in and suggested a solution. Approximately eighty per cent. of the air we breathe contains nitrogen. But this element, in the free state, is useless for most purposes—whether to feed the soil, or feed man, or prepare munitions. And to combine it with oxygen to get the necessary nitrates is not an easy matter. However, the chemists attacked the problem. Particularly so the chemists of Germany.

As soon as war was declared, Germany's supply of Chili saltpeter was cut off. But by that time her chemists had solved the problem of the fixation of nitrogen—as the process by which the nitrogen of the air is converted into nitrates is called.

There is much plausibility in the assertion that the militaristic clique in Prussia awaited but the solution to this problem before finding a convenient pretext for war.

When, after the battle of the Marne, defeat stared the Prussians, who helped them to stave off defeat? The chemist with his gas. And when our allies had developed effective counter-measures for this added horror of modern warfare, the German chemist introduced the gas shell. It is now being pretty generally conceded by those in a position to know, that the recent German drives on the western front have been made possible not merely because of added numbers from the East, nor because of Von Hutier's new form of attack, but to a large extent on account of a prodigal expenditure of "mustard" gas. Re-read the story of the evacuation of Armentières.

What has saved Germany thus far is not her organization, nor her generals. It is her chemists. Every one talks of Hindenburg and Ludendorff. But how many have heard of Baeyer and Fischer?

Let not the reader, however, get the impression that Germany has a monopoly of chemists. By no means. Germany has made much of her chemists, whereas we have neglected ours. The German government, through its industrial organizations, has constantly encouraged them to further efforts; our statesmen, steeped in Greek, Latin or Tammany classics, have not.

But the dawn of a brighter day is arising. The world tragedy has opened the eyes of our people. When peace and goodwill once again reign among us, let us hope that the leaders of at least two of our great democracies will take the lesson to heart—not, indeed, to encourage their scientists to devise further, and more horrible means for conducting warfare, as is done by the present German government, but to encourage our plodding philosophers in the search they love best—unfolding the secrets of nature, thereby adding to the knowledge and happiness of the world.

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Chemistry in America is a very young product. It probably received its impetus from the Englishman, Priestly, the discoverer of oxygen, who came to these shores in the latter part of the last century, and from Robert Hare, the inventor of the oxy-hydrogen blowpipe. The flame was kept a-burning by a succession of well-known teachers at Harvard and Pennsylvania, among whom may be mentioned Cooke and Wolcott Gibbs. The more modern period was ushered in by Charles Eliot in Boston, Ira Remsen at Johns Hopkins, Frederick Chandler at Columbia, and E. F. Smith at Pennsylvania.

From small beginnings the science has enlarged a thousandfold. Our American Chemical Society has a membership of 10,000. It publishes an erudite journal, devoted to recording the results of research by its members; a chemical abstracts, embracing a digest of the world's chemical literature; and an industrial journal which, in the last four or five years, has become unrivaled.

Germany has for so long appropriated the ideas of some of the master minds of Britain and France, that it is a rather welcome sign to find the Americans turning the tables upon the Germans now. Some of our leading chemists have received their post-graduate training in Germany. These men are making use of their training with a vengeance. Apart from their immediate services to the government, these men have, during the last twenty-five years, trained the younger generation to a degree which has called forth the admiration of their German masters. Even before the war, the number of American chemists at German universities showed a marked falling off. Our post-graduate departments at Harvard, at Chicago, at California, at Columbia, at Johns Hopkins, at Yale, at Michigan, and others, have become the serious rivals of those at Berlin and Munich, Bonn and Heidelberg.

The chemical advisers of the government are directing, and the larger body of chemists are actively engaged in work on explosives, on gases, on foods, on iron and steel, on copper, on aluminum, on fertilizer, on dyes, on drugs, on rubber, on leather, on paints, on glass, on fats and soaps, on paper, on cement, etc. Who are some of these men, so indispensable for the successful prosecution of the war, and just as indispensable for the development of our country after the war?

In the mathematical branch of the science—that more particularly concerned with the fundamental properties of matter—we probably lead all other countries. Willard Gibbs (Yale), one of the profoundest mathematicians of the century, was the forerunner. Closely following upon him came Edward Morley (Western Reserve), whose work on the composition of water is among the classics in chemistry. At present there is T. W. Richards (Harvard), winner of the Nobel prize, and the great authority on the weight relationships of the elements; G. N. Lewis (California), the energy exponent, now with the oversea forces; and workers on the theories of solution and other kindred subjects; H. N. Morse and the late H. C. Jones (Johns Hopkins); W. D. Harkins (Chicago); W. D. Bancroft (Cornell); E. W. Washburn (Illinois); J. L. R. Morgan and James Kendal (Columbia); M. Rosanoff (Pittsburgh), etc.

Closely associated with these, but particularly well known as the authors of successful text-books, may be mentioned A. Smith (Columbia); J. Stieglitz (Chicago); and C. Baskerville (College of the City of New York).

In the analytical field—the detection and estimation of the elements and their compounds—we have F. W. Clarke (U. S. Geol. Survey), particularly well known for his work on chemical geology; F. A. Gooch (Yale), originator of several well-known appliances in the laboratory; W. F. Hillebrand (U. S. Geol. Survey), the author of a splendid work on rock analysis, etc.

In the field of organic chemistry, where we are introduced to glycerin, carbolic acid and toluol, leading on to the chemistry of modern explosives, we have M. Gomberg (Michigan) ; M. T. Bogert, in charge of the chemical service section of the National Army, and J. M. Nelson (Columbia), T. B. Johnson (Yale), W. A. Noyes (Illinois), C. S. Hudson (U. S. Dept. of Agriculture), etc. This branch of the science suffered a grievous loss a short time ago by the death of J. U. Nef (Chicago).

Again, in the most recent offshoot of organic chemistry, the application of the science to physiology, to biology and to medicine in general, we are easily the leaders. There come to mind the names of such men as O. Folin (Harvard), who has revolutionized clinical chemistry; P. A. Levene and D. D. Van Slyke (Rockefeller Institute), R. H. Chittenden and L. B. Mendel (Yale), E. V. McCollum and W. Jones (Johns Hopkins), W. J. Gies (Columbia), H. D. Dakin (Herter Laboratory), C. Funk, C. Alsberg (Chief Chemist, U. S. Dept. of Agriculture), K. G. Falk (Harriman Research Laboratory), P. B. Hawk (Jefferson Medical College), A. E. Taylor (Pennsylvania), G. Lusk and S. R. Benedict (Cornell), A. P. Mathews (Chicago), etc.

Closely associated with these, but more narrowly restricted to foods, may be mentioned H. C. Sherman (Columbia), H. W. Wiley, and W. D. Bigelow.

Among those particularly interested in its agricultural aspects are O. Schreiner (U. S. Bureau of Soils), C. B. Lipman (California), and T. J. Lipman (Rutgers).

Though J. Loeb (Rockefeller Institute) and W. J. V. Osterhout (Harvard) are directors of departments of biology and botany, respectively, their researches are wholly biochemical in nature.

As might be expected, in the industrial field, where the inventive genius finds an immediate and successful outlet, the American chemist has done wonders. Every student who takes a course in elementary chemistry knows how Goodyear vulcanized rubber, how Hall revolutionized the manufacture of aluminum, how Frasch devised an ingenious method for extracting sulphur from the Louisiana ores, how Castner invented his electrolytic process for the production of caustic soda, used in enormous quantities in the manufacture of soap, how Acheson discovered carborundum, artificial graphite, and deflocculated graphite, and how Baekeland discovered bakelite, used in electrical appliances, phonographic records, etc. And now younger America, in the shape of W. F. Rittman, is busily engaged in perfecting a process for "cracking" petroleum under pressure, whereby an amazing number of raw products necessary for explosives, and dyes, and motive power, are formed. And again, one of Parr's students at Illinois has developed a method of extracting the dye from the wood of the osage orange, which dye is now used for the khaki uniform cloth of the American Army.

But this is not all. Bucher, of Brown University, and the chemists of the General Electric Company, are rapidly concluding their researches into a practical method of extracting the nitrogen from the air; Day, of the Geophysical Laboratory, is preparing an optical glass which is superior to the German product; and various biochemists are putting on the market Salvarsan, substitutes for cocaine, adrenalin, and dozens of other German-made substances badly needed by our medical men.

And so the story goes.

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A most encouraging augury for the future is the close cooperation that is beginning to exist between the universities, on the one hand, and the industries, on the other. For much of this our thanks are due to the late R. K. Duncan, for some years the director of the Mellon Institute at Pittsburgh, and the originator of the Mellon Industrial Fellowships. Incidentally, Duncan's two or three books on popular chemistry remind one of a Huxley or a Tyndall.

An even better sign of the times is the research laboratories that our industrial corporations are establishing. A model of its kind is the chemical laboratory of the General Electric Company. Its two chief chemists, W. R. Whitney and I. Langmuir, are among the leaders in their profession in this country.